Crime Laboratory Division

The Missouri State Highway Patrol Crime Laboratory opened in May 1936, only five years after the inception of the agency itself. Very early in the history of the Patrol, forensic science was recognized as an essential element of the criminal investigation process. It was one of the first crime laboratories in the country. The lab was housed first in two rooms within the Broadway State Office Building. In 1963, the laboratory moved into 4,000 square feet of space in the basement of General Headquarters on Elm Street. It moved again in October 1979, this time into 11,000 square feet of the Annex Building. Today, it fills approximately 16,000 square feet in that same building. Over the years, the laboratory system has expanded with the addition of six satellite laboratories strategically located throughout the state. The Crime Lab facility at GHQ was originally constructed to accommodate a staff of 15 personnel and a caseload of 2,500 cases annually. At the beginning of 2003, the laboratory included 45 individuals and processed nearly four times the volume of work in the same original 11,000 square feet of space.

Criminalists' desks were located adjacent to chemical storage cabinets and alongside the actual evidence processing locations, creating workflow problems and safety concerns. With the addition of approximately 4,000 square feet of new space in 2004, the criminalists now have desk areas which are physically separate from the chemical storage and evidence analysis areas, significantly reducing chemical and biological exposure to personnel who are working at their desks and relieving congestion in the analytical spaces. The lab also reconfigured the instrumentation and examination areas to make efficient use of the space, which has resulted in greatly improved workflow and efficiency.

The satellite laboratories are an integral part of the laboratory system. The first one to open was the Troop G Satellite Laboratory located in Willow Springs in February 1975. It opened in the basement of the Troop G Headquarters. In September 1997, the staff moved into a new laboratory facility located on Troop G Headquarters grounds.

The Troop H Satellite Laboratory, located on the Troop H Headquarters grounds in St. Joseph, opened in February 1977. In 1988, an addition to the original laboratory structure nearly doubled the space of the laboratory.

The Troop B Satellite Laboratory located on the Troop B Headquarters grounds in Macon opened in February 1977. In 1988, an addition was made to the structure to nearly double the working space.

The Troop C Satellite Laboratory was opened in January 1992. Originally the laboratory had been operated as the Jefferson County Regional Crime Laboratory. It was located at Jefferson Community College in Hillsboro. When the regional laboratory closed, the previous management requested the MSHP take over the operation of the laboratory. A new laboratory facility was constructed in April 1999, in Park Hills, to house the Troop C laboratory.

The Troop D Satellite Laboratory was opened in January 1993 to serve the Patrol's needs in the Troop D area. Soon afterward, the Springfield Police Department elected to close its laboratory, and a merger occurred between the Springfield crime lab and the Highway Patrol crime lab system to serve the forensic needs of Springfield and surrounding counties. The building currently housing the lab is the property of and located on the campus of Missouri State University.

In mid-2006, the Southeast Missouri Regional Crime Lab in Cape Girardeau became part of the Missouri State Highway Patrol Crime Laboratory System. It is located near the campus of Southeast Missouri State University and will serve the southeast Missouri area. The SEMO lab was founded under the leadership of Dr. Robert C. Briner in 1970, through funding received from a federal grant program. It operated through Southeast Missouri State University. The laboratory has served many law enforcement agencies in the Southeast Missouri area over the past three decades.

For over 30 years, the SEMO lab was funded by federal and state grants, as well as through local agency fees. Relying on these uncertain funding sources made it increasingly difficult for SEMO to maintain the services that the local law enforcement community needed. Through the efforts of Senator Rob Mayer, Senator Jason Crowell, and Representative Scott Lipke, funding was provided to merge the SEMO Crime Lab into the Missouri State Highway Patrol crime lab system. Governor Matt Blunt approved the merger and signed the budget, establishing the funding to make this merger possible.

Effective July 1, 2006, the seven employees of the SEMO Crime Lab officially became employees of the Missouri State Highway Patrol. Crime Lab employees then began working on the complex task of integrating the Missouri State Highway Patrol procedures and policies with the Cape Girardeau lab. It is anticipated the new Troop E lab will achieve accreditation through the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB) within the next year, and gain approval from the FBI to participate in the CODIS DNA database in the next six months.

At the beginning of its operation, the Patrol Crime Laboratory was manned by uniformed officers of the Patrol. This continued until the first two civilian chemists were hired in 1962. The first chemist hired was Afton Ware, although he preceded C. Frank Durham by only one month. For approximately the first 20 years the chemists were "generalists". The tests they performed included blood alcohol, chemical, microscopic, and trace evidence. They conducted all analyses that were not firearms, toolmarks, or fingerprints, which were being analyzed by trained uniformed officers.

"Essentially, it was on-the-job training. Afton and I visited the St. Louis City Lab and the St. Louis County Coroner's Lab. They gave us some of their procedures. And, we had books in the laboratory library that helped us," said retired Criminalist Supervisor C. Frank Durham in a 2006 interview.

In the late '60s, the uniformed officers began turning over their firearms, toolmarks, and fingerprint work to civilians. In 1968, Tom Buel, who had been the Patrol's civilian photographer since 1965, added firearms, toolmarks, and footwear to his duties. In 1975, he began a two-year apprenticeship program in questioned documents, which was taught by the Crime Lab's director, Kenneth Miller.

In 1974, Don Lock was hired to do fingerprint analyses and, along with Tom Buel and August Nilges, began analyzing questioned documents. He had previously been working in the Patrol's Criminal Records Division classifying and identifying inked prints. In 1987, he became the supervisor of both the Questioned Documents and Latent Fingerprints sections of the laboratory.

In the early 1980s, the chemists became more specialized because of increasing workloads and advances in technology. During that time, the Serology Section of the laboratory, which was using polymorphic enzymes comparisons and blood typing on a daily basis, started making advancements that would lead to the development of the present DNA casework section.

"They can do so much more now than we could do then. Their results--there were times we could not say there was definitely a match. Now, with DNA, they can make positive matches. The instrumentation is much more involved. Initially, a lot of the chemical procedures were very tedious and took a long time. It isn't easy now, but it's different," said Durham.

The implementation of DNA analysis by the MSHP Crime Laboratory began with an idea, an application, a journey, and a commitment.

The idea -- Colonel C.E. Fisher attended a meeting in 1988 where a new testing procedure that "typed" a person's DNA was discussed. Col. Fisher returned to Jefferson City and discussed with Laboratory Director Lt. Frank Burkhead the pros and cons of DNA typing. They agreed the MSHP Crime Laboratory should be on the cutting edge of technology, and that the timing was right for implementation of this new technology in Missouri.

The application -- Soon after this discussion, the FBI Laboratory began soliciting applicants for their Visiting Scientist Program at their research lab in Quantico, Virginia. The program was instituted so state and local forensic scientists from the United States could work in tandem with FBI researchers to develop a national system for analyzing human DNA. All participants would be taught to use the same techniques and procedures for typing human DNA. Since all of the labs in the country were using the same techniques, their results would be compatible and could be incorporated (eventually) into a national DNA database. The FBI benefited by developing a consistent analytical system and by utilizing the labor of the scientists from the participating labs to develop a national DNA population database that could be used to calculate the rarity of a DNA type. In April 1988, Lt. Burkhead received one of the applications and discussed with Tom Grant, the supervisor of the MSHP Lab's Serology Section, the possibilities of Tom's submitting an application. Tom returned the application and waited.

In July 1988, the FBI sent a letter confirming that Tom had been chosen to participate. MSHP's participation included four months of service at the research lab in Quantico.

The journey -- The timing allowed Tom's family to accompany him to Virginia to learn about and to experience life on the East Coast. The Grants rented a townhouse in Fredericksburg, Virginia, and Tom began working with the FBI. The Grant children--Tanya, Travis, and Tracy--enrolled in the Spotsylvania County Public Schools. Louise was the coordinator of everyone's schedules and kept the family together. Their free time experiences were varied and valuable. They saw the ocean for the first time, played on the beach in November and December, found sea skate egg cases that washed up on the shore, discovered that starfish get real smelly when they are drying, visited Washington D.C., met the director of the FBI, flew in a FBI helicopter, worshipped at a huge Baptist church, and much, much, more!

The commitment -- For four months, Tom helped work on the population database and was trained to perform RFLP (Restriction Fragment Length Polymorphism) DNA analysis. His new knowledge helped equip the DNA Section of the laboratory. Lt. Burkhead committed lab funds to purchase the necessary equipment to set up a DNA testing laboratory. Tom frequently called the Patrol Laboratory to speak with Cary and Lori Maloney, who were holding down the casework responsibilities in his absence. They ordered the equipment he recommended from his experience in the research lab. The funding for this budding new section came from $160,000 in drug forfeiture funds.

When Tom returned to Missouri in February 1989, the MSHP Laboratory was equipped and ready to begin validation of DNA analysis. Training of the Maloneys started and progressed rapidly. On October 1, 1990, the first DNA case was started in the MSHP Crime Laboratory.

The techniques continued to develop and, in 1999, PCR (Polymerase Chain Reaction) using STR (Short Tandem Repeats) was initiated on casework and is the technique currently being used. Over the past 16 years much has changed in the field of DNA analysis -- new techniques, quicker turnaround times, more discriminating results.

The Serology Section staff has expanded from three people to 15. The MSHP Laboratory is still on the cutting edge of the technology and the FBI Visiting Scientist Program was the initial link in an ever-growing chain of events.

In 1986, Carl Rothove, who came to the Lab in 1977, became the supervisor of the newly formed Trace Evidence Section. The Trace Evidence Section's repertoire includes fibers, hairs, glass, paint, filaments, soil, arson, explosives, gunshot residue, and distance determinations.

Also in 1986, the Toxicology Section of the laboratory was established. This enabled the Laboratory to identify drugs in body fluids. The Toxicology Section also claimed the blood alcohol program. The first supervisor of this section was Dr. Kwei Su, who now runs her own private lab.

With the specialization of the Trace Evidence and Toxicology Sections, the Drug Chemistry Section was established. The analysis of street drugs became their sole responsibility.

Technology continues to change in every specialty in the Laboratory, and personnel continue to educate themselves with professional meetings and other educational opportunities. As technology and workloads have changed, the titles of the personnel have evolved as well. Sometime in the 1970s, people who did latent print, firearms, and questioned documents work were titled as “forensic analysts” and everyone else was a “forensic chemist”. In 1983, a new category, serologist, was added for those working with blood and body fluid stains. In 1992, everyone became classified as “criminalists”, with the name of the section of their specialty following that classification.

In 1991, Senate Bill 578 was passed establishing the DNA Profiling Section of the Laboratory. This section was established to collect and process DNA samples from convicted felons of certain violent crimes and to record them in a state and national database. The Missouri State Highway Patrol Crime Laboratory was required to collect and analyze the DNA samples. The resultant DNA profiles were entered into a state and national DNA database, CODIS (Combined DNA Index System). Those profiles were then compared to the DNA profiles from evidence collected at a crime scene.

On October 16, 2000, a Cessna airplane piloted by Randy Carnahan crashed on a heavily wooded hillside south of St. Louis near Hillsboro, Missouri. Governor Mel Carnahan and his aide, Chris Sifford, were occupants of the plane. All three men were killed in the crash.

Because of the stature of the occupants of the plane and the importance of the transfer of power in state government, it became vitally important to positively identify the deceased quickly. Positive identification can be accomplished by several means, two of which are performed routinely at the Missouri State Highway Patrol Crime Lab in Jefferson City. Fingerprints and DNA analysis, techniques performed daily at the state laboratory, would prove essential to the timely identification of the victims of this plane crash.

Almost immediately after the crash materials began coming to the lab. Before any comparisons could be made with evidence from the crash site, known standards from the three individuals had to be established. A call went out to track down any 10-print cards that may have been on file from any of the deceased. Personal effects such as toothbrushes, razors, and clothing were submitted to establish a DNA profile for each individual. Analyses began on these items as Dr. Mary Case, the medical examiner in St. Louis, conducted preliminary examinations on the crash site evidence. The lab prepared to work around the clock in anticipation of the crash samples that would be submitted.

In addition to the work done to identify the crash victims, other investigations were being conducted to determine the cause of the crash. The lab became peripherally involved in these as well. The Trace Evidence Section was called upon to analyze aviation fuel samples for any contaminants. The Drug

Analysis Section was asked to analyze an unknown powder found at the site. These analyses were conducted with the utmost speed and accuracy.

As samples from the crash victims came in from the Medical Examiner's Office, they were quickly logged in by the Laboratory Records and Evidence Control Clerks and prepared by Criminalists for fingerprint and DNA analysis. Many of these exams extended late into the night as the samples were submitted at all hours of the day. Using recently obtained 10-print cards and the newly developed DNA standards, Criminalists were able to positively identify what biological crash materials belonged to which of the three deceased. By working around the clock, the lab was able to make many of these identifications in time for the funeral arrangements a few days later. The official report was generated later, when all analyses had been completed. DNA results were eventually used by the Federal Aviation Administration to resolve identification issues with some of the tissue samples they subjected to toxicology examinations.

On March 7, 2001 the Missouri House of Representatives, Ninety-first General Assembly passed House Resolutions 761 through 771, recognizing the exemplary work done by Crime Lab personnel during this time of crisis. It serves as public testament to the competence and professionalism of Missouri State Highway Patrol Crime Lab personnel.

In 2000, Criminalist Susanne Brenneke was tasked with validating a new kit--the PowerPlex®16 system--prior to using it in the Crime Laboratory. This kit was better suited for DNA analysis in the Crime Lab due to its greater efficiency and lower cost. The study was designed to evaluate the concordance, reproducibility, sensitivity, and forensic applicability of the system. The validation of the kit was completed in October 2000 with the conclusion that this system was easy to use and it was the most efficient and discriminating multiplex kit available at the time. The Patrol's Crime Lab was one of the first to validate this system, which led to Promega Corporation inviting Criminalist Brenneke to share her findings at a meeting of the European STR Working Group in Kracow, Poland, on September 11, 2000. The meeting provided a forum that facilitated global networking among forensic scientists and encouraged discussion in forensic analysis.

In 2001, the premier issue of "Under The Scope" rolled off the press. This newsletter is an effective tool for educating our submitting agencies on current crime laboratory issues. "Under The Scope" is a way to disseminate information such as techniques, procedures, and policies.

Since its creation the Patrol's Crime Laboratory has accepted submissions from any Missouri law enforcement agency. According to a biennial report of the Patrol, the Laboratory worked 230 cases in 1937-1938. Criminal case submissions to the Laboratory have grown to 19,153 in 2005. Presently, approximately 75 percent of the cases received by the Crime Laboratory Division are submitted by outside agencies such as municipal police departments, county sheriff offices, and county coroners. Forensic services are provided to these

submitting agencies at no charge. Forensic examination of evidence is essential for the successful investigation and prosecution of criminal cases.

Currently, the only uniformed member in the Crime Laboratory is the division's director. The remaining 83 employees are civilian, consisting of criminalists, who specialize in their area of expertise, and support staff.

The main Laboratory at General Headquarters is a full-service laboratory, providing services in firearms and toolmarks, fingerprints, trace evidence, DNA casework, DNA profiling, drug chemistry, and toxicology. Questioned document examinations were discontinued in 2002. There is a general trend in forensic laboratories nationwide to dissolve document examinations due to a focus on error rates, reproducibility, and acceptance within the scientific community.

In 2003, the Crime Laboratory Division worked closely with Information Systems Division and software consultants from Confidus on the final design and development of a replacement for the existing laboratory computer system. The old system was based on the AS/400 platform and was totally inadequate for present demands. The new system, known as a Laboratory Information Management System (LIMS), will integrate the many databases in use throughout the laboratory and also completely integrate the GHQ system with the Satellite Labs (presently, they are separate standalone systems). The new LIMS, based on Lotus Notes, will also be integrated with the Property Control system. Through a federal grant, the Lab was able to pay for additional costs necessary to add bar code technology to this system. Wireless scanners based on PDAs record chain of custody transfers from one person or location to another electronically, enabling us to instantly locate and create a chain of custody record for any piece of evidence in any Patrol location throughout the state.

The passage of Senate Bill 1000 during the 2004 legislation session has had a tremendous impact on law enforcement's ability to solve crimes through the use of the Combined DNA Index System (CODIS). This legislation expanded Missouri's offender DNA database law to require collection of DNA from <u>all</u> felons effective January 1, 2005 (under the previous Missouri law, DNA was only collected from violent offenders and certain other sexual offenders). The expansion of this program is funded by a court fee of $30 assessed on every felony conviction and $15 on every misdemeanor conviction in the State. This law increased estimated annual DNA submissions to the Missouri State Highway Patrol Crime Laboratory from approximately 2,200 offender samples per year to over <u>28,000</u> per year, with an additional <u>100,000</u> DNA samples to be collected from prior offenders who are now eligible for collection for past felonies.

It has long been known that a large percentage of serious crimes are committed by persons previously convicted of lesser felony offenses. This offender database is used to search against forensic DNA samples from unsolved crimes at the state and national level. The Missouri forensic database contains DNA from over 4,000 unsolved crimes, and it is constantly being searched against newly entered offender DNA samples.

In the 12 prior years, under the old law, the Crime Laboratory analyzed a total of 27,211 convicted offender DNA samples and uploaded the profiles into the state and national CODIS database. Since the change in the law took effect, the database has increased in size from 27,211 DNA profiles to over 100,000 convicted offender profiles.

As expected, the large increase in DNA profiles from relatively recent offenders has resulted in a tremendous increase in CODIS "hits", where old unsolved crimes have hit against a newly collected offender.

For 2004, the last year the Laboratory worked under the old law, there were a total of 41 CODIS "hits". For 2005, the first year under the "all felon" law, these hits increased to 175. In the first eight months of 2006 alone, there have been an astounding 506 "hits". While the majority of the hits that have occurred since the change in the law have been related to property crimes such as burglary, they also include 57 homicides, 73 rapes, and 40 sexual assaults. A number of these hits are very high profile cases. Without this new valuable tool, these crimes would have remained unsolved.

The power of CODIS resides in its ability to identify perpetrators of unsolved crimes. Also, the database has the potential to identify repeat offenders and in doing so, help reduce or prevent the occurrence of serial crimes. The high degree of certainty that DNA analysis provides has caused it to become one of the most important criminal justice tools ever utilized. DNA is equally effective in exonerating the innocent as convicting the guilty.

Also in 2004, Crime Laboratory Division personnel worked closely with the State Health Lab to establish a coordinated plan of action to be used in the event of a chemical terrorism incident. A network of specialists are involved. They represent laboratories and other facilities from many areas of state government, as well as members of the U.S. Army's Fort Leonard Wood chemical response unit.

The Crime Laboratory Division constructed a highly informative website accessible from the Patrol's main website. Many of the publications the Crime Laboratory Division distributes, such as the "Evidence Handbook" and the "Under the Scope" newsletters, are available electronically on the website. To view the Crime Lab website, go to www.mshp.dps.mo.gov, and click on the link to "Crime Lab".

Criminalist Mike Baker of the GHQ Trace Evidence Section was the recipient of a DPS Meritorious Service Award in recognition for his exemplary service to the agency. Mike has a special skill in maintaining and repairing analytical instrumentation and was responsible for saving the Patrol well over $10,000 in repair costs in 2004, by applying his skills, determination, and motivation to help keep the instrumentation at the GHQ Lab and the satellite labs in peak operating condition.

A new scanning electron microscope interfaced with an energy dispersive X-ray spectrometer (SEM/EDX) was installed in 2005. This new addition will better prepare the lab to examine evidence and perform particle identification in

incidents related to suspected terror threats. In addition, it will have a significant impact on the trace evidence section's backlog of gunshot residues cases: a GSR stub that once took eight hours to analyze now takes 30 minutes.

The Latent Print Section purchased two "SpeckFinders" to aid with the comparison of difficult prints. These instruments utilize a video system and built-in monitors to help visualize latent prints. This system is very useful when a latent print examiner needs to collaborate with another examiner when performing latent print comparisons. These devices can be interfaced with a computer to capture the image digitally.

The Latent Print Section had a hit in the FBI's IAFIS database on a robbery/triple homicide case from Littleton, Colorado. The homicide occurred in 2002 and one customer and two employees were killed. In 2005, prints developed from the scene were forwarded to our lab to be searched through the Missouri AFIS database. When the AFIS search came up negative, the prints were searched through the FBI's IAFIS database. This case had remained unsolved until IAFIS generated a potential candidate.

Another case was solved with the help of the FBI's IAFIS database. A stealing case originating in Taney County, Missouri, and later associated with crimes from Arizona, Colorado, Idaho, Montana, Nebraska, Texas, and Wyoming. The suspect, using several aliases, stole hundreds of thousands of dollars worth of merchandise from several ranches. An FBI task force had been formed in an attempt to locate this individual. The IAFIS hit was the first piece of evidence identifying the suspect and tying him to these crimes.

Since the beginning of the Laboratory, one of the main functions of the employees has been to testify in court as to the findings of their analyses. In 2005, personnel spent a total of 441 days testifying in court proceedings.

Currently, the Patrol Laboratory is accredited by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB). It was first accredited in 1984, and was only the 23rd laboratory in the nation to earn this distinction. The accreditation process involves internal annual reviews, external DNA audits every two years, and a comprehensive external inspection of the entire Laboratory operation every five years by ASCLD/LAB inspectors. The purpose of this is to be able to demonstrate the Laboratory is complying with required accreditation standards and criteria, thus ensuring the examinations being conducted are of the highest possible quality.

As mentioned earlier, the Missouri State Highway Patrol Crime Laboratory Division has been in existence since 1936. Forensic science and law enforcement have been partners in the criminal investigation process for many years, and this relationship has only grown stronger through time. From those humble origins in 1936 has evolved a nationally respected and internationally accredited crime laboratory system that is a recognized leader in state-of-the-art forensic science services in the 21st century. The pride and commitment to quality that defined the laboratory 70 years ago endure even more strongly today.